FEE

The fee for the course is $465. This includes lecture notes, text, and supplies. Make checks and purchase orders payable to GWU, Continuing Engineering Education. Free parking is provided. Participants may delay payment until arrival.

TEXT

Manual of Remote Sensing

HOUSING AND MEALS

Housing and meals are not provided. However, there is a wide variety of hotels, motels, and restaurants nearby. Information on available accommodations will be sent if requested.

LOCATION AND HOURS

Orientation will be at 8:15 a.m. on the first day in room 641 of the University Library, 2130 H St., N.W. (corner of 22nd and H), Washington, D.C. Classes will be held from 8:30 a.m. to 4:15 p.m.

CERTIFICATE

Those attending the full course will receive a Certificate of Completion.

CONTINUING EDUCATION UNITS (CEU)

Continuing Education Units (3.0) will be awarded for the satisfactory completion of this course. The CEU is a uniform unit of measurement for recording noncredit learning in qualified continuing education programs. It provides a standardized means for business, industry, and government to measure in-service education. A permanent transferable record is maintained.

APPLICATIONS

Tentative or final registration should be made as soon as practicable. Apply by letter, telephone, or purchase order to Continuing Engineering Education Program, George Washington University, Washington, D.C. 20052, **(202) 676-6106** or the toll free number **(800) 424-9773**.

DETACH ENTIRE PANEL AND MAIL TO:

Continuing Engineering Education, The George Washington

registration form

DIGITAL IMAGE PROCESSING OF EARTH
OBSERVATION SENSOR DATA
June 6-10, 1977

Name

Title

Organization

Address

City ___ State ___ Zip

Company Phone ___ Home Phone

☐ Register me for course No. ___

☐ Payment Enclosed ☐ Bill Me ☐ Bill Office

Please Note: We occasionally mail to selected lists which cannot be cross-checked against our files. Therefore, you may receive a duplicate of this announcement. If so, we hope you will pass it along to an interested associate.

Please Return Entire Panel

Continuing Engineering Education
George Washington University
Washington, D.C. 20052

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BOX 3
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SCHOOL OF ENGINEERING AND APPLIED SCIENCE

CONTINUING ENGINEERING EDUCATION PROGRAM

DIGITAL IMAGE PROCESSING of EARTH OBSERVATION SENSOR DATA

June 6-10, 1977

ROUTE TO:

THE GEORGE WASHINGTON UNIVERSITY

WASHINGTON, D.C. 20052
(202) 676-6106
(800) 424-9773

Course No. 307
DIGITAL IMAGE PROCESSING OF EARTH OBSERVATION SENSOR DATA

DESCRIPTION

This course is designed for physical scientists, photo interpreters, systems analysts, engineers, and programmers who need a better knowledge of advanced sensors and digital image correction enhancement and information extraction techniques. The objectives of the course are to provide the participants with an understanding of the principles and operation of advanced sensors, the errors in the sensor data, various techniques for measuring the errors, systems for processing the data to remove the errors, and the techniques and systems to enhance the data and extract information. The course will describe the latest image processing methodologies and results that can be obtained using these techniques and advanced systems. The concepts and techniques will be presented so that the participants need not have extensive knowledge of mathematics, computers, programming, or image processing.

OUTLINE AND SCHEDULE

First Day

REMOTE SENSING PROGRAM OVERVIEW

History of program
Summary of current and future earth observation programs
    LANDSAT Program (including follow-on program)
    SKYLAB Program
    Heat Capacity Mapper Program
    SEASAT Program
    Tiros-N
    Nimbus-G Program
Significant scientific results to date

SENSORS AND GROUND SYSTEMS

Multispectral scanner sensors
Return beam vidicon sensor
Aircraft camera systems
Sensor error characteristics
Ground systems for processing sensor data
Techniques for determining sensor errors
Characteristics of ground control points
Digital image processing concepts
Techniques for sensor error correction
Results of sensor error correction
Digital mosaicking techniques
Registration of multiple scenes

Second Day

Image enhancement techniques/results
Image processing fundamentals
    Concept of picture element
    Spread function
    Modulation transfer function
    Image space sampling concepts

Image processing operations
Image processing results (Star, Mariner, Radar, Landsat, Lunar)
Color concepts/balance, film recording
Stereo imaging/viewing
JPL image processing system
Noise removal techniques

Third Day

Radiometric calibration and correction
Mathematical development of attitude models
Automatic ground control location, subpixel location techniques
Resampling theory and implementation
Image processing software organization and execution
Image processing timing
Image data formats
A research image processing system
Programming technology and methodology

Fourth Day

Multispectral classification concepts
Mathematical foundation for multispectral classification
NASA earth resources interactive processing system
The large area crop inventory experiment (LACIE)
Agricultural inventory and geological exploration experimental results
Future trends/applications for multispectral classification
NASA master data processor — system requirements, functions, throughput, performance and cost
Film recording technology
Future trends for image processing

Fifth Day

Radar fundamentals — physics governing active microwave surveillance
Synthetic aperture radar (SAR) concepts — utilization of platform motion to increase effective antenna aperture for purposes of increased image resolution
SAR processing techniques — summary of techniques applicable to the formation of SAR image data
Implementation example — development of algorithms and processing to produce high resolution images from satellite radar data

INSTRUCTORS

Ralph Bernstein (course coordinator) is the manager of Advanced Image Processing Analysis and Development at IBM Federal Systems Division, Gaithersburg, Md. A principal investigator in the Earth Resources Technology Satellite (ERTS) program now known as LANDSAT, he developed advanced digital image processing techniques for processing multispectral scanner and return beam vidicon data. For this development he received a NASA Medal for Exceptional Scientific Achievement. He has written a number of technical papers on digital processing of high resolution earth observation satellite sensor data and contributed to several books.

Frederic C. Billingsley, Supervisor, Science Data Analysis Development, Jet Propulsion Laboratory, California Institute of Technology, is now on temporary duty at NASA headquarters. He was employed for 11 years at the General Electric Research Laboratory. At JPL he has been responsible for the development of the Image Processing Laboratory and digital image processing for the Ranger, Mariner IV, Surveyor, Mariner 1969, Mariner 1971, and a National Institutes of Health grant. He has been a member of the NASA Optical Telescope Technology Workshop, and a co-investigator on the Apollo Lunar Multispectral Photography Experiment S-158.

Dallam G. Ferneyhough, Jr., is the manager of the Image Processing Analysis Department, IBM, Gaithersburg, Md. His department was responsible for the technical performance of IBM's LANDSAT contract to develop all-digital methods of correcting LANDSAT images and a contract from the Bureau of Land Management for a mosaic of several ERTS MSS frames. He is the author of several technical papers on image processing.

S. G. Francisco, IBM Corporation, is presently working in advanced digital SAR data processing. Prior to this he held assignments as manager of ocean systems and manager of systems engineering on the large aperture seismic array project. He was responsible for the development and application of real time signal processing for advanced signals systems involving networks of sensors and computers. He has taught graduate and undergraduate courses in control systems signal processing and digital design.

Douglas S. Ingram, manager, Mission Analysis and Engineering, IBM, Clearlake, Tx., is involved in demonstrating the feasibility of using remotely sensed data for practical applications. The information extracted from remotely sensed data requires image enhanced multivariate information theory and error analysis. Currently he is working on practical applications for agriculture and mineral identification. Dr. Ingram has taught graduate courses in estimation theory and pattern recognition and has published in numerous journals.

Stephen W. Murphrey is a Senior Associate Programmer in the Image Processing Analysis Department of the Federal Systems Division, IBM, Gaithersburg, Md. Mr. Murphrey has served as principal programmer on many major contracts, including a Multi-Satellite Data Processing Software Package for installation and implementation on the IBM 360/95 computer in New York, and an experimental system for precision geometric correction of LANDSAT MSS and RBV images.

William E. Stoney, Jr., is the Director of Earth Observations Programs, NASA Office of Applications, reporting directly to the Associate Administrator. He is responsible for directing NASA's earth resources, meteorological, and other earth observations activities. Prior to this assignment he was in charge of the former Apollo Test Division under the heading of Apollo Engineering. He was responsible for the technical and engineering aspects of the program and reported to the Apollo Program Director.